

Appl. No.: 09/868,716
Amdt. dated 04/28/2005
Reply to Office action of October 29, 2004

REMARKS/ARGUMENTS

Reconsideration and allowance of the above identified application is respectfully requested in light of the following remarks and arguments.

Brief Summary of the Invention

The claimed invention is directed to a method for detecting defects, in a non-contacting manner, on shot cores and core packets used in the foundry industry. By way of background, as part of the casting of mold parts, it is conventional to first form shot cores which are formed as separate pieces and then joined together to form a casting mold or a core packet. These core packets are then filled with molten metal to cast the finished product.

Shot cores and core packets of the described type tend to have defects, especially along their edges, which are thus imparted to the cast products. The cast products require substantial cooling time before they can be measured and inspected by conventional contact procedures, and should there be a defect in a shot core or core packet, a large number of cast parts would be produced before the defect could be detected. The present invention effectively alleviates this problem by providing an efficient and reliable system for detecting defects in the shot cores or core packets before they are placed in production.

In carrying out the method of the invention, the articles being analyzed are illuminated by at least two light sources preferably operating in sequence and emanating from different directions, and a camera, which preferably is at a fixed location, is used for recording each article and the shadows resulting from the illumination. The recorded data is

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processed in a computer, where the recorded image is compared with a record of reference data.

As an important feature of the claimed invention, the light sources are positioned so as to produce shadows which magnify an area of each shot core or core packet. Also, the processing of the recorded data includes processing a recorded image which includes the magnifying shadows. With this arrangement, it is possible to perform a more detailed examination of critical areas of the article than could be achieved by an examination of only the article itself. This novel feature is further discussed at page 5, lines 1-15 of the specification.

The Rejections Under 35 USC §103

Claims 30-34, 37, and 42 were rejected in the Official Action based upon a proposed combination of Bartulovic (Patent No. 6,177,682) in view of Pöhlandt (Patent No. 5,996,681).

The patent to Bartulovic relates to the inspection of the coplanarity (relative heights), colinearity (alignment), and the height of each individual ball of the solder balls on the ball grid array of an integrated circuit chip. In particular, the inspection process consists of measuring height, position and shape of the solder balls in the array based upon an analysis of shadow images which are formed by one or more x-ray or light sources.

The teaching of Bartulovic is thus specifically directed to the inspection of minute (col. 2, line 54) solder balls which are formed in a regular array on an IC chip. This is seen to be very different from and non-analogous to the claimed invention, which involves the inspection for edge defects which may be present in individual shot cores or core packets used in the foundry industry.

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In an attempt to remedy this deficiency of the Bartulovic patent, the Examiner has turned to the Pöhlandt patent which discloses the use of cameras 5 to create optical images of foundry cores 3 for quality control purposes. However, there is no suggestion in Pöhlandt of analyzing shadows to inspect for edge defects. This being the case, and for the further reason that Pöhlandt is non-analogous of the inspection of an array of minute objects as taught by Bartulovic, there would have been no apparent motivation or reason to combine the teachings of the two cited references. In the absence of such motivation or reason for the combination, the rejection cannot stand and should be withdrawn, see for example In re Lee, 61 USPQ 2d 1430 (Fed. Cir. 2002).

Base Claims 30 and 40 also highlight the fact that in the method of the present invention, the shadow images are magnified, which serves to facilitate recognition and recordation of any edge defects, as well as the processing of the information by comparing it to a record of reference data.

With regard to the magnification feature, the Examiner has taken the position that any shadow formed by the point light sources of Bartulovic would be inherently larger than the object itself. This is not seen to be necessarily true however, since the size of the shadow depends on the angle at which the light is directed. For example, if the angle is close to vertical, the shadow would be smaller than the object itself. In any event, the Bartulovic patent fails to teach or suggest anything relating the magnification concept as employed in the claimed invention, and the benefits flowing therefrom, and the Pöhlandt patent does not remedy this deficiency.

Dependent Claim 31 recites that the camera of the claimed invention is arranged at a fixed location. As far as we

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understand the teaching of Bartulovic, both the camera and the light sources have to be moved. Thus this claim is seen to further define over the prior art.

Dependent Claims 36, 38-40, 45, 46, and 47 have been rejected as being unpatentable over Bartulovic in view of Pöhlandt, and further in view of one of the several secondary references. The secondary references were cited with reference to the various features of these claims, but none are seen to supply the deficiencies of the two primary references as noted above. It is accordingly submitted that these claims are also in condition for allowance.

For the reasons set forth above, it is respectfully submitted that all of the pending claims are in condition for immediate allowance, and such action is solicited.

Respectfully submitted,

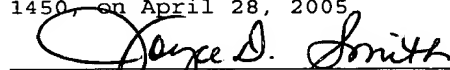


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